TRANSPORTATION AND TRAVEL

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CONTAINERIZATION OF MILITARY VEHICLES

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September 1997

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CONTAINERIZATION OF MILITARY VEHICLES

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SECTION I. INTRODUCTION

This publication provides users with the proper methods for securing military equipment in International Organization for Standardization (ISO) containers. It comprises basic information from experiences gained through participating in many military exercises. This publication includes information on both ISO dry cargo containers (enclosed boxes) and platform containers (flatracks).

Remember, all equipment loaded into intermodal containers and flatracks must be firmly and properly secured to counteract longitudinal (fore and aft), lateral (side-to-side), and vertical (up and down) forces. All hazardous material must be in compliance with the Code of Federal Regulations (CFR) Title 49 and the International Maritime Dangerous Goods (IMDG) code.

This publication focuses on container and flatrack ***intermodal*** movements. For tiedown procedures on flatracks transported solely by sea refer to: **MTMCTEA Ref 95-55-22, *Marine Lifting and Lashing Handbook.***

All tiedown procedures in this book are appropriate for highway and marine movement. Some tiedown methods are also approved for general rail service, but others are only approved for specialized rail moves that will require special care.

MTMCTEA welcomes comments and recommendations for improving this publication. Readers may send their suggestions by letter, on DA Form 2028, or on a marked copy of the publication to:

Director
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Transportation Engineering Agency,
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Newport News, VA 23606-2574
DSN 927-4646 or (757) 878-4646

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SECTION II. GENERAL CARGO AND LOADING PRINCIPLES

A. Dry Cargo Containers

Dry cargo containers commonly transport general cargo. General cargo can be loose, palletized, liquids in drums, boxed, crated, or otherwise configured. Because each cargo load is different, this pamphlet cannot show tiedown patterns for all possible loads. This section presents general principles for securing cargo. The following references provide additional guidance:

A *Shipper's Guide to Stowage of Cargo in Marine Containers* - Published by the US Department of Transportation Maritime Administration (1982), Stock No. 050-015-0004-1.

Available from: **Superintendent of Documents**
US Government Printing Office
Washington, DC 20402

AAR Rules Governing the Loading of Commodities on Open Top Cars and Trailers - ***Section 7, Rules Governing the Loading of Commodities on Open Top Trailers*** **and** ***Containers to be Handled in Trailer-on-Flat-Car (TOFC) Service,*** **published by the AAR and** ***Intermodal Loading Guide for Products in Closed Trailers and Containers,*** **Circular No. 43-C, Pamphlet No. 45, BOE Pamphlet No. 6C**, July 1995.

Available from: Association of American Railroads
Central Operations Group
50th Street, NW
Washington, DC 20001
Phone (202) 639-2211
Fax (202) 639-2156

Army Materiel Command (AMC) ***19-48-Series Container Outloading Drawings***. The US Army Defense Ammunition Center and School (USADACS), Savanna, Illinois, publishes these detailed drawings. You should refer to these drawings if you are shipping ammunition. The drawings are available from:

Director
USADACS
ATTN: SIOAC-Det
Savanna, IL 61074-9639
DSN 585-8927
Com (815) 273-8927

Before loading, containers should be inspected to ensure they comply with IMDG, Title 49 CFR, and MIL-HDBK-138A requirements. Although each ISO container should have a valid Convention for Safe Containers (CSC) Safety Approval Plate, its serviceability should be verified with a visual examination prior to each use.

For intermodal transportation, you must secure cargo and comply with administrative requirements to satisfy the most demanding mode. Preparation and documentation of HAZMAT cargo should be adequate for all modes that will be encountered between orgin and destination. This means HAZMAT must comply with Title CFR 49 and the IMDG code. Securement methods must meet the requirements of all modes that will be used throughout the journey. If any mode requires battery terminals to be disconnected, then this should be accomplished at the orgin of the intermodal shipment.

Special preparations needed for ocean or intratheater movement should be accomplished once the cargo is secured on the

container at orgin. Some examples of special preparations needed for ocean transport (but not usually required by railroads in CONUS) are:

a. Disconnecting vehicle batteries.

b. Folding in or removing overwidth mirrors (such as so-called "California mirrors").

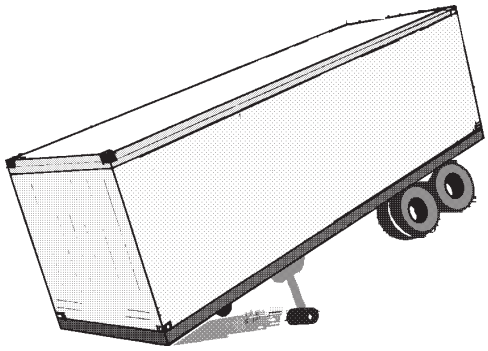
Dry cargo containers can carry many types of cargo - boxes, palletized/unitized loads, bags and sacks, drums of liquid, and other items. This publication cannot show detailed securement drawings for every possible container load. However, it does show good loading and securing practices to follow for general cargo.

1. Cargo must be stowed and secured so that it cannot move while in transit.

2. Cargo should be stowed to have good cube usage.

3. Forklift tine openings in pallets should face the door of the container.

4. Cargo and cargo weight should be evenly distributed throughout the container.



Containers should not be overloaded or loaded unevenly.

a. The **gross** weight should not exceed 52,900 pounds for a 20-foot container or 67,200 pounds for a 40-foot container.

b. The weight of the cargo plus the weight of the container is the **gross** weight. At times, containers must be loaded to less than their gross weights to comply with physical or legal limits of specific transportation modes and any additional limitations established by the supported CINC.

For example: the M872 semitrailer is physically able to carry a 67,200-pound 40-foot container. However, the M915/M872 tractor-trailer combination is only able to carry a total container load of about 44,000 pounds without exceeding legal highway weight limits in the United States. Maximum container weights in other countries and with other prime movers may vary.

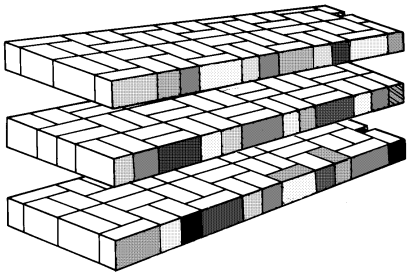
NOTE

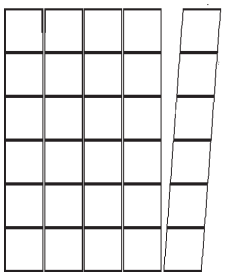
The PLS cannot handle containers over 33,000 pounds.

There are also good practices to follow with specific types of cargo.

B. Cardboard Boxes and Cartons

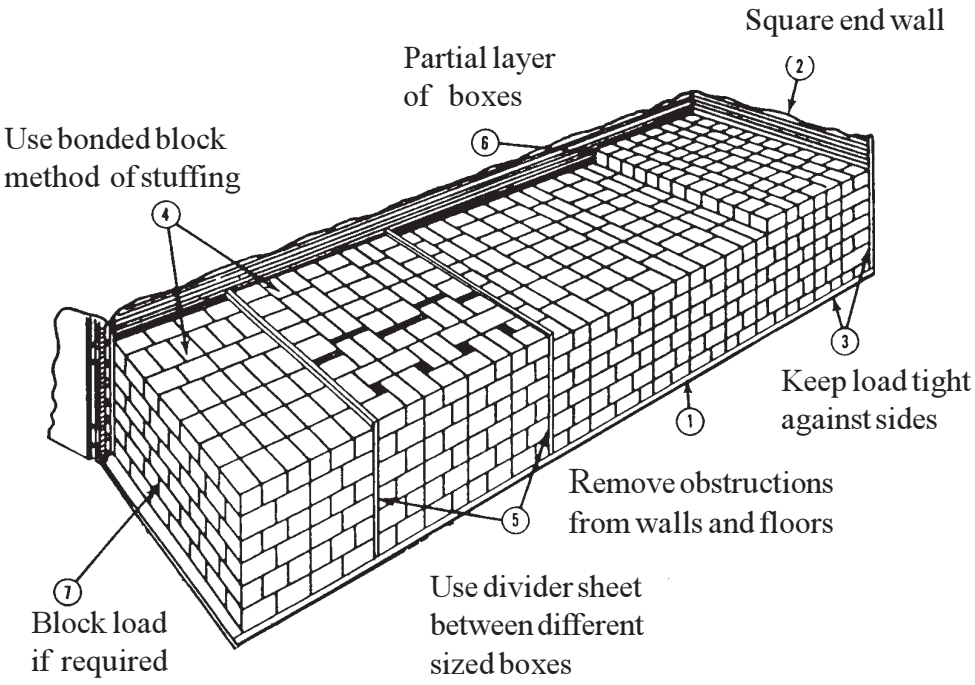
Cardboard boxes and cartons should be laced and staggered (the bonded block method).





Pure vertical stacks shift more easily

The laced pattern of the bonded block method provides more resistance to load shifting than simply stacking the cartons vertically. The load should be tight and square from front to back and from wall to wall. Separate groups of different sized cartons with divider sheets of quarter inch or thicker plywood, oriented strand board (OSB), or 80 point solid fiberboard.

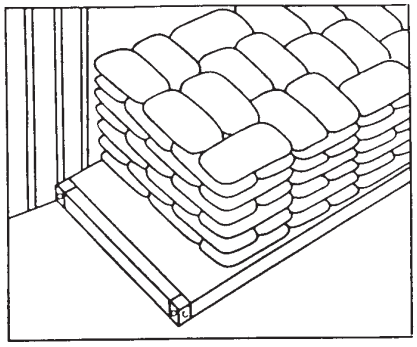


C. Unitized/Palletized Loads

Cartons and cases that are unitized usually contribute to efficient operations. Forklifts can rapidly stuff containers with palletized loads. As with a manually-stacked load, the cases should be interlocked in each unit to reduce shifting. Unitized loads should be secured with banding or shrink wrap. If cargo is stacked no more than 43 inches high on a pallet, it will be possible to load two tiers of pallets in the container.

D. Bagged, Sacked, and Baled Cargo

Cargo consisting of bags, sacks, and bales should normally be placed on dunnage - either racks, pallets, or packing material. You should load the cargo in cross-tiers as shown on the right. The cross-tier method provides the most stability. It is used to reduce the risk of cargo shifting. Container loads of bagged material should be braced across the door to prevent the bags from falling out when the container door is opened.



Remember:

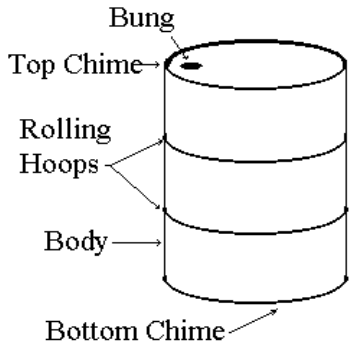
1. Use sufficient dunnage layer on container deck to provide area for condensate drainage.

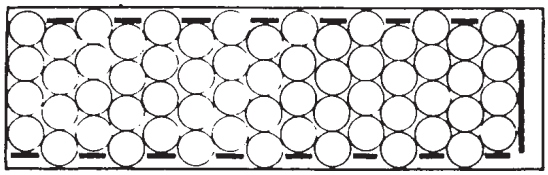
2. Separate bags, sacks, or bales from other cargo by using divider sheets or auxiliary decks.

3. When stuffing bales, provide dividers between rows and tiers to prevent chafing and friction between metal bands or strapping.

4. Flatten bags.

E. Drums





Drums should be placed upright with the bungs on top, packed tightly, and, preferably, palletized.

Drums and barrels containing petroleum products are not shipped in the same container with general cargo. Drums and barrels should be placed tightly against each other to avoid shifting as shown above. It may be possible to stow drums with rolling hoops more tightly by elevating alternating rows on risers.

If you are double-tiering drums with ridged chimes, you should load them so that the chimes interlock. Tiers of drums without interlocking chimes should be separated with dunnage. Of course, drums should not be double-tiered if this will overload the container.

Drums secured with steel straps should be protected with 1/2-inch fiberboard at points where the straps press against the drums.

WARNING

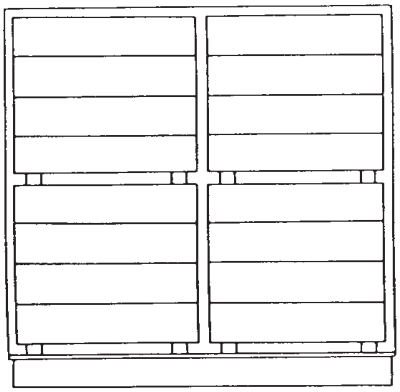
Some drums are made of light gauge metal and are designed for only one trip. These drums should **NOT** be re-used.

Refer to the AAR ***Intermodal Loading Guide for Products in Closed Trailers and Containers,*** **Circular No. 43-C, Pamphlet No. 45, BOE Pamphlet No. 6C,** for specific guidance on using some commercially available securing devices for shipping drums.

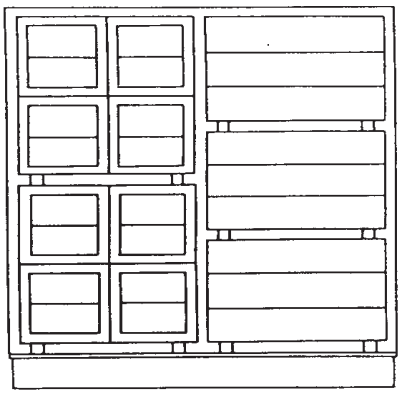
F. Wood Boxes and Crates

You can stuff small unpalletized boxes and crates by following the same procedures that are used for shipping cartons. Crates and boxes may be placed on their sides or ends to maximize space provided vendor instructions on the box do not prohibit it. A heavy box or crate should never be placed so that it rests on top and inside the four corners of the box beneath it. You should place heavy items on the container floor with pallet access openings facing the container door. Place boxes or crates containing liquids on the bottom level of the load. Install bracing so that the boxes and crates will not shift in transit or fall out when the container door is opened at the destination.

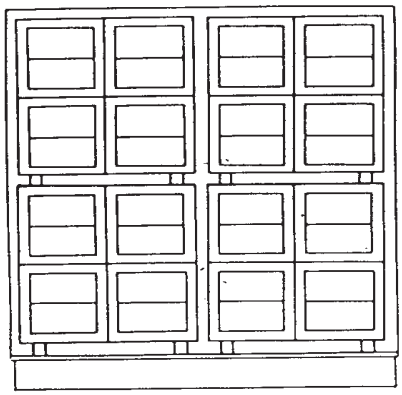
Rear view



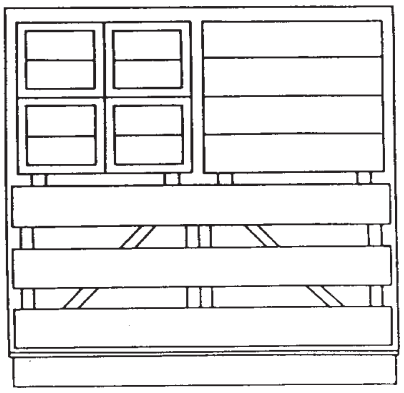
INTERIOR CONTAINER STUFFING ARRANGEMENT No. 1



INTERIOR CONTAINER STUFFING ARRANGEMENT No. 2



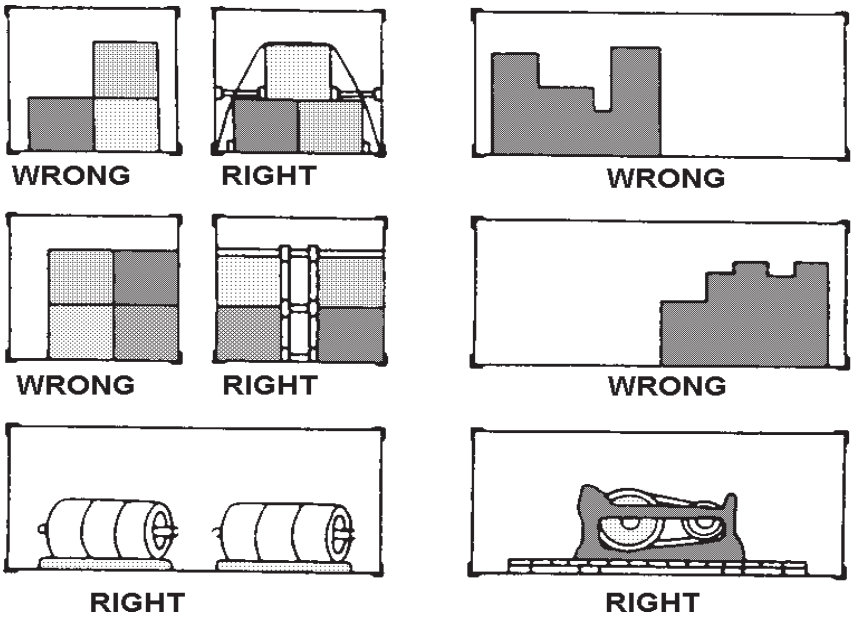
INTERIOR CONTAINER STUFFING ARRANGEMENT No. 3



INTERIOR CONTAINER STUFFING ARRANGEMENT No. 4

G. Machinery and Heavy-End Items

Heavy cargo must be securely braced and blocked on all sides to prevent any lateral or lengthwise motion, since its concentrated weight will cause major damage to the container or other contents if load shifting occurs. Specific procedures for securing certain vehicles are shown in the next chapter. However, this section presents general procedures for loading and securing heavy loads. In general terms the container should be loaded such that the cargo's center of gravity is centered longitudinally on the container floor. Loads bearing on the floor must not exceed 2,500 pounds per linear foot (running longitudinally). It is very important to minimize concentrated loads that can damage the container floor. With extra heavy loads, load spreading shoring or skids will be necessary. All shoring and bracing must bear on a structural member of the container and not on the panel sides of the container alone. In some instances extremely dense items may need to be bolted to the container decks. You should get permission from the container owner for this method of securing. The illustration below shows **right and wrong methods** for loading heavy equipment.

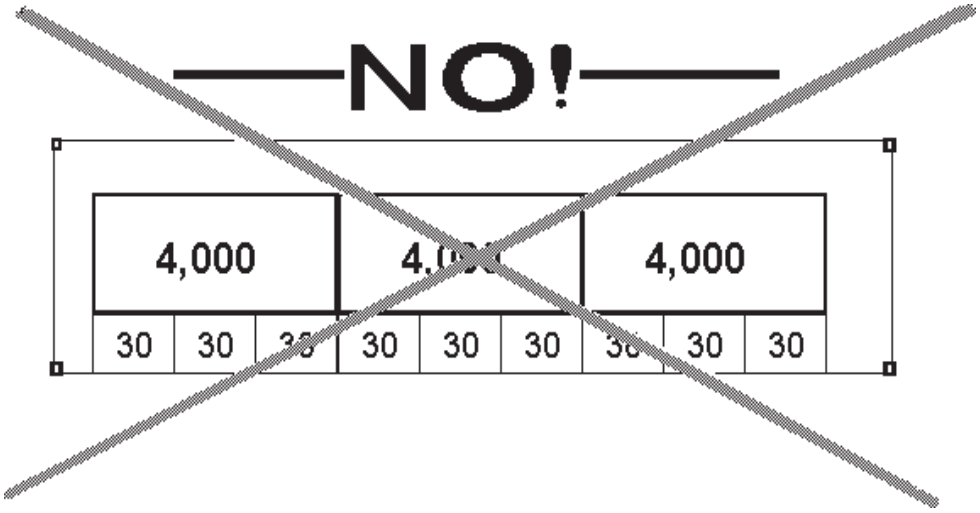


Distribution of heavy loads in containers

H. Mixed Commodities

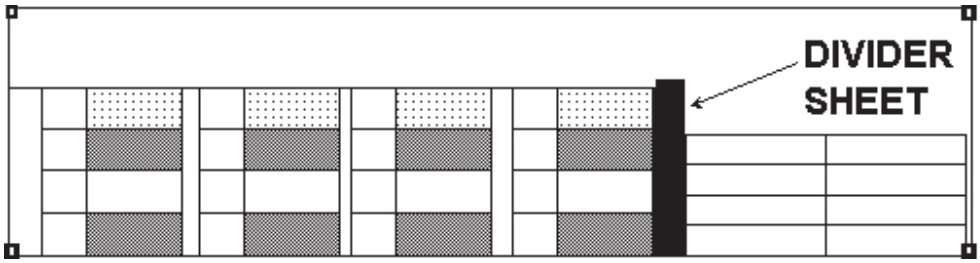
To achieve unit integrity or maximum cube utilization, there will be many occasions when more than one commodity is stuffed into the same container. Along with the general stuffing techniques listed throughout this section, the following guidelines should be followed when stuffing mixed commodities:

1. Do **not** load heavier cargo on top of light cargo.



2. A commodity giving off an odor should never be stuffed with a commodity that would be affected by an odor.

3. When stuffing commodities with different packaging (cartons with crates), be sure to use divider sheets between the different kinds to separate them and prevent damage.



4. If wet and dry cargoes are stuffed in the same containers, use dunnage to separate the commodities. However, it is generally best to avoid shipping liquids with dry cargo.

5. Container doors are not to be used to secure loads. You can use bullboards wedged in container door posts and plywood sheets or pallets to prevent mixed or boxed cargo from contacting the container door. To protect doors from ammunition shipments refer to specific 19-48 series container outloading drawings.

6. Do not stow hazardous materials of different classes in the same container if any segregation requirements are shown in the IMDG code for the different classes involved.

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SECTION III. VEHICLES IN DRY CARGO CONTAINERS

High Mobility Multipurpose Wheeled Vehicles (HMMWVs), Commercial Utility Cargo Vehicles (CUCVs), and single axle trailers make up the majority of containerizable vehicles.

This publication documents the techniques developed and used during the 1993 Team Spirit Intermodal Initiative and the shipment of M119 howitzers from Rock Island, Illinois, to Hawaii.

As a general rule, two HMMWVs or three single axle trailers can be stuffed into a standard 40-foot container. Depending on the trailer dimensions, it may be possible to stuff four trailers into a 40-foot container by allowing the trailers to overlap.

NOTE

The same procedures can be used in any size container

WARNING

Securing procedures covered in this pamphlet are sufficient for marine and highway shipment only. These procedures may be sufficient for special rail transport when extra gentle handling such as unit trains or double stack service is guaranteed by the railroad. The only procedures sufficient for standard carload rail transport are the ones illustrated for the M119 Howitzer.

A. Stuffing Requirements

Vehicles should be loaded into the container facing out to allow for quick unloading. All batteries must be disconnected and the terminals taped. All secondary loads must be secured to the vehicle to prevent movement and damage. The vehicle fuel levels should be no more than 1/4 tank. When motor vehicles with fuel in their tanks are stowed in a closed freight container, the following warning must be affixed to the access doors:

WARNING

"MAY CONTAIN EXPLOSIVE MIXTURES WITH AIR - KEEP IGNITION SOURCES AWAY WHEN OPENING."

This warning must be on a contrasting background and must be legible from a distance of 8 meters (26 feet).

If a loading dock of equal height to the container on chassis is unavailable, the container should be removed from the chassis and placed on the ground. A small ramp 8 feet wide x 6 inches high and 16 to 24 inches long will simplify loading, see figures 3-1 and 3-2 for examples. If time and space allow, chock blocks should be laid out in pairs, and the four securing nails should be partially driven in. Also, predrilling these four holes in the chocks will save time when nailing and reduce the amount of damage done to the choc block. Duplex (double headed) nails should be used to allow for easy removal. See figure 3-3 for chock block dimensions and nailing requireiments. Flashlights may be necessary when nailing the chock blocks inside the container. Gloves should be worn at all times. Initially, lumber 4-inch x 4-inch can be placed along tlhe side or sides of the container to act as guides for the vehicles. Ground guides should be used at all times. Allow 6 inches of clearance between the vehicles and the ends of the container. Use commercially approved seal-locks to secure the container doors.

NOTE

There should be an ambulance or some type of emergency medical facilities set up at the stuffing site

B. Tool List

A complete list of tools required are as follows:

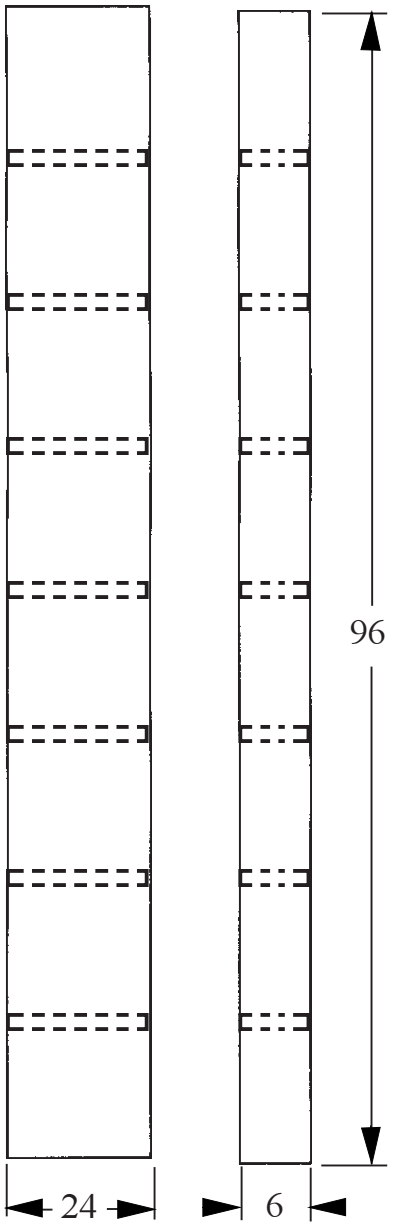
GLOVES - for all operations
SAFETY GLASSES - for all operations

HARD HATS/KEVLAR HELMET - for all operations
FLASHLIGHTS - for nighttime/inside containers
WRENCHES - sizes required for disconnecting batteries
PLIERS - for getting terminals off battery post
RAGS - for cleaning grease off terminals
TAPE - for taping terminals
HAMMERS - for nailing chock blocks
EAR PLUGS - for soldiers nailing chock blocks
PRY BARS - for removing chock blocks
BOLT CUTTERS/ WIRE CUTTERS - for cutting seals off containers

C. Lumber Requirements

Blocking may be fabricated using dressed lumber of the nominal sizes indicated on each drawing. For example, a dressed 2 x 4 is really 1-1/2 by 3-1/2 inches and may be used where a 2 x 4 is required. List of lumber required for each vehicle is as follows:

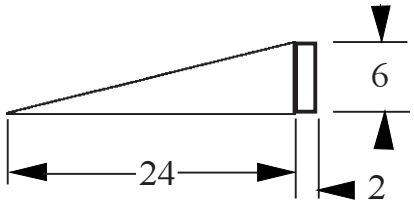
ITEM	TYPE LUMBER	BOARD FEET
HMMWV/	2 x 6	20
CUCV	6 x 8	8
TRAILER	2 x 6	23.6
RESTRAINED	6 x 8	8
WITH 9 GAUGE	2 x 4	1.33
WIRE	1 x 4	.65
HOWITZER	2 x 4	1.33
	2 x 6	16
	2 x 10	18.8
	4 x 4	2.4
	4 x 6	5.6
RAMP	2 x 6	17
	1/2" plywood	8



MATERIELS

9 - 2 x 6 x 24, CUT ON ANGLE
1 - 1/2 x 24 x 96 PLYWOOD
1 - 2 x 6 x 96

NOTE:
ALL DIMENSIONS ARE IN INCHES. DRAWING NOT TO SCALE



SEE NEXT PAGE FOR PHOTOGRAPH

Figure 3-1. Loading ramp for loading container off chassis.

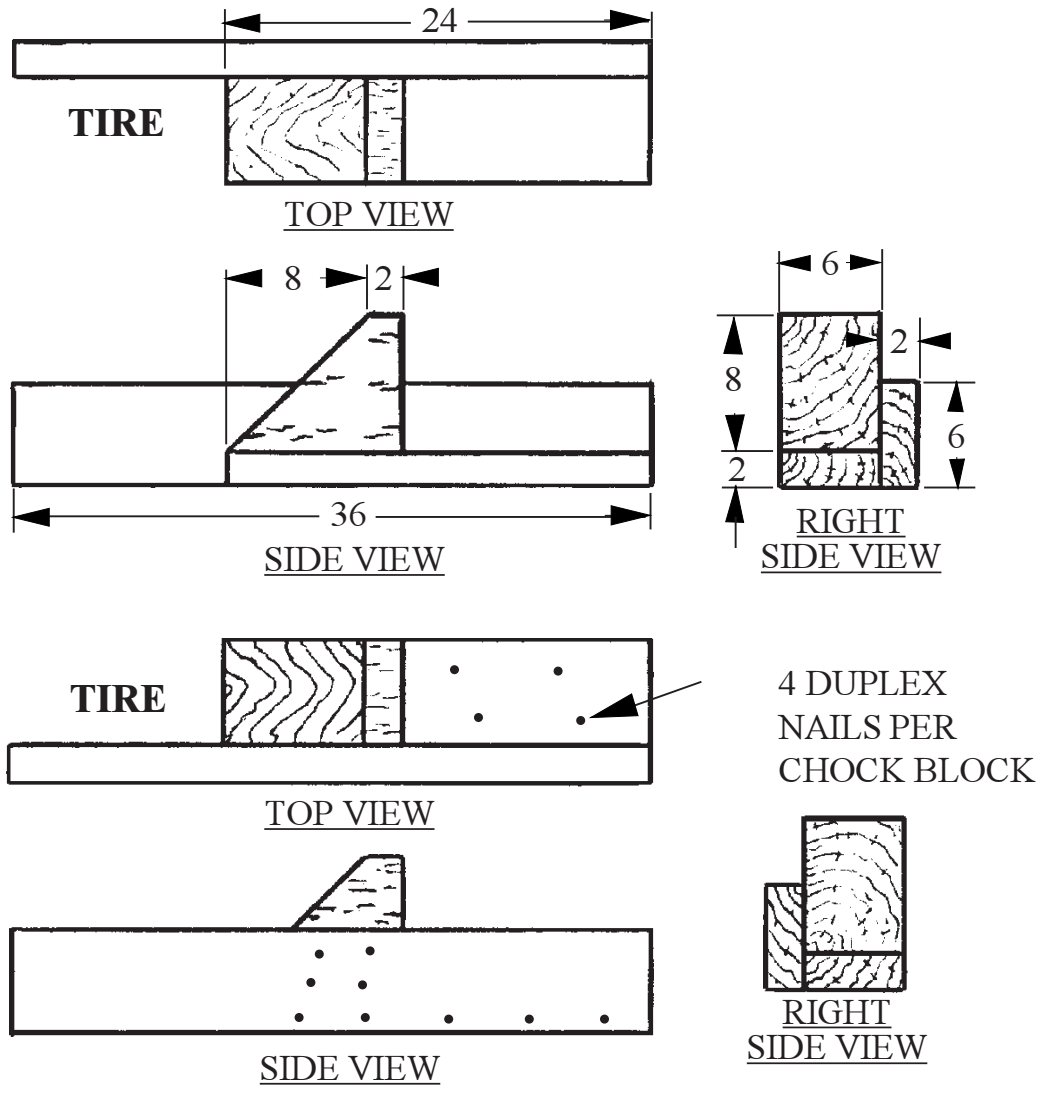
Figure 3-2. Container loading ramp.

D. HMMWVs

The cab canvas back wall should be removed or loosened to allow the driver to exit the vehicle after it is loaded. All doors should be removed and stowed in the vehicle. Mirrors should be folded and all antennas removed. Side mount antennas should be removed completely including the bracket. These vehicles should be backed into the container until the driver's door opening reaches the container door. Now the batteries should be disconnected and the terminals taped. With the driver still in the vehicle, manually push the HMMWV into place. Set the parking brake, leave the vehicle in neutral, and nail the chock blocks in place. Ensure tension on parking brake is properly adjusted. See figures 3-3 through 3-5 for chock block construction and placement. Caution must be taken when climbing over the HMMWV to avoid damaging the hood and grill.

E. CUCVs

CUCVs allow more room for exiting the vehicle; however, the vehicle should be centered in the container or closer to the curb side to allow maximum room for exiting the vehicle once it is in place. The driver may have to climb out of the window to exit the vehicle. The vehicle should be backed in until the back of the cab is even with the container door opening. Batteries should be disconnected and the terminals taped. Now the vehicle can be manually pushed into place, the brakes set, transmission left in neutral, and the chock blocks nailed in place. Chock blocks will be placed in the same configuration as for the HMMWV in figures 3-4 and 3-5.



NINE, 20-D NAILS INTO SIDE OF CHOCK BLOCK. ALSO FOUR, 20-D NAILS IN BOTTOM, DRIVEN THROUGH 2 X 6 UP INTO CHOCK BLOCK.

NOTES:

1. BOTH BLOCKS HAVE THE SAME DIMENSIONS.
2. THEY ARE OPPOSING BLOCKS AND SHOULD BE CONSTRUCTED AND APPLIED IN PAIRS.
3. ALL DIMENSIONS ARE IN INCHES.

Figure 3-3. Chock blocks with side bracing.

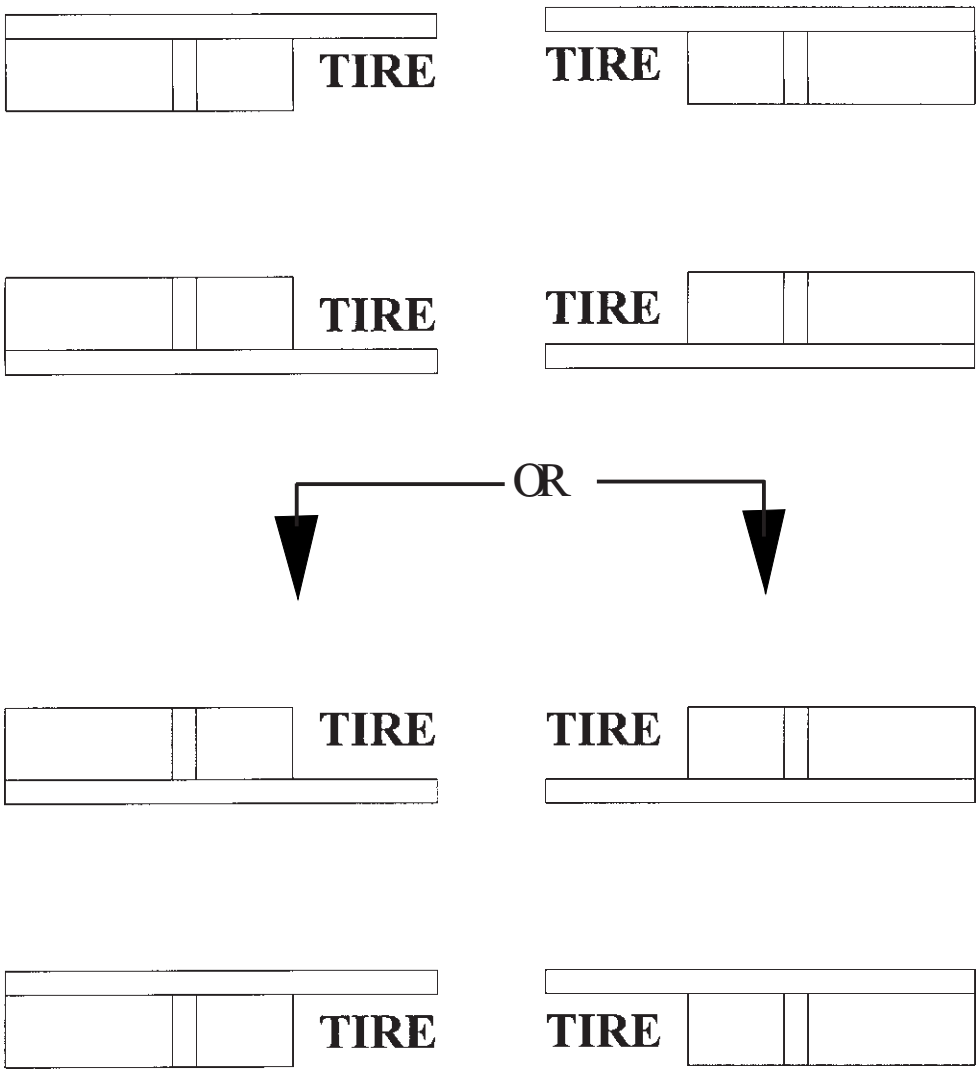


Figure 3-4. Two-axle vehicle tire chocking patterns.

Figure 3-5. HMMWV front wheels with chock blocks.

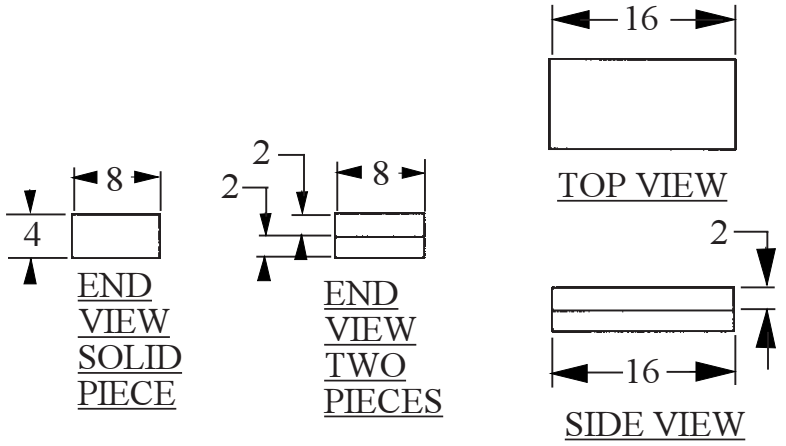
F. Trailers

Trailer without prime mover

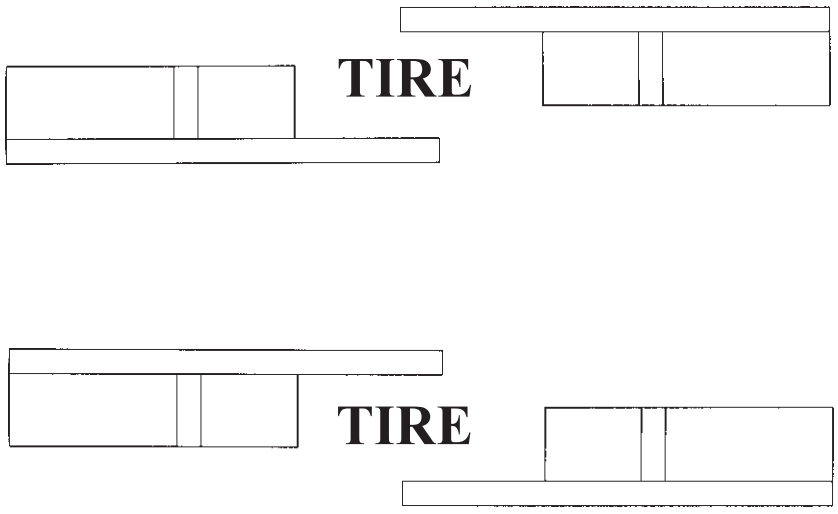
WARNING

Do not stow trailers more tightly than necessary when containerizing. Three trailers should fit within each container, but the trailers should be spaced so that the tongue of the front trailer is about 6 to 12 inches from the container door. This reduces the chance of damaging the tongue of the second trailer while unloading the front trailer from the container.

All batteries on trailers should be disconnected and the terminals taped before they reach the loading site. Prime movers or forklifts with pintle attachments can be used to push trailers partially into containers. Once the wheels are in the container, the brake should be set, the jack or landing leg should be set in place, the trailer removed from the prime mover or forklift, and the prime mover driven out of the way. Trailers can be pushed in manually if a loading dock equal in height to the container on chassis is available. The trailer can now be manually pushed into place, the brakes set, and the chock blocks nailed into place. See figure 3-6 for chock block placement. Make sure all hoses and wires are out of the way before lowering the tongue. Next, the jack or landing leg is retracted and the tongue is placed on shoring. The dimensions of the shoring are on figure 3-6. If a solid block is used, four duplex nails should be used to toenail the block in place. If the shoring is constructed out of two blocks, the first block should be secured to the container floor using four, 20-D nails. The second block is then secured on top of the first using four duplex nails. Ensure that nylon straps or #9 wire will not pinch or damage any hoses or wires before applying tension. The trailer tongue must be secured (figs 3-7 and 3-8) with nylon ratchet straps or number 9 tempered wire.

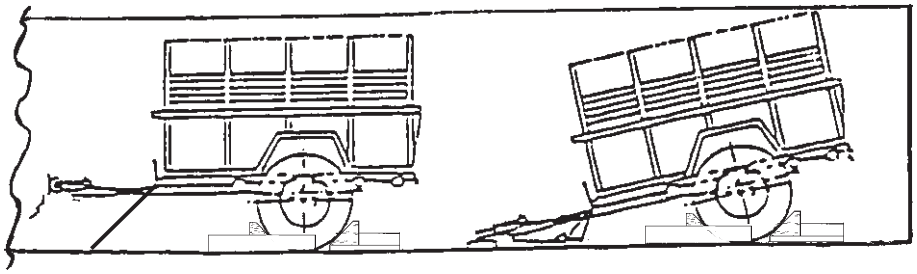


Trailer tongue shoring



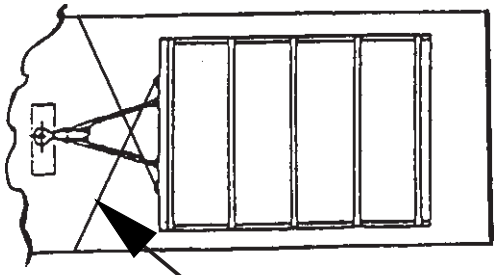
NOTE:
ALL DIMENSIONS ARE IN INCHES

Figure 3-6. Single axle trailer blocking and shoring diagram.



TRAILER COUPLED TO PRIME MOVER

TRAILER SECURED ALONE



TRAILER TONGUE SHORING, SEE FIGURE 6 FOR DETAILS

NYLON RATCHET STRAPS OVER TRAILER TONGUE. 2 REQUIRED PER TRAILER

NOTES:
1. FOUR CHOCK BLOCKS REQUIRED PER TRAILER. SEE FIGURE 6 FOR DETAILS. THIS APPLIES FOR TRAILERS SHIPPED ALONE OR COUPLED TO PRIME MOVER.

2. # 9 TEMPERED OR ANNEALED WIRE CAN BE USED IN PLACE OF RATCHET STRAPS. SEE FIGURE 9 FOR APPLICATION OF # 9 WIRE.

CAUTION
ADDITIONAL SHORING MAY BE REQUIRED TO PROVIDE CLEARANCE FOR SOME TRAILERS WITH BOWS AND CANVASES INSTALLED.

Figure 3-7. Single axle trailer coupled to prime mover or separate.

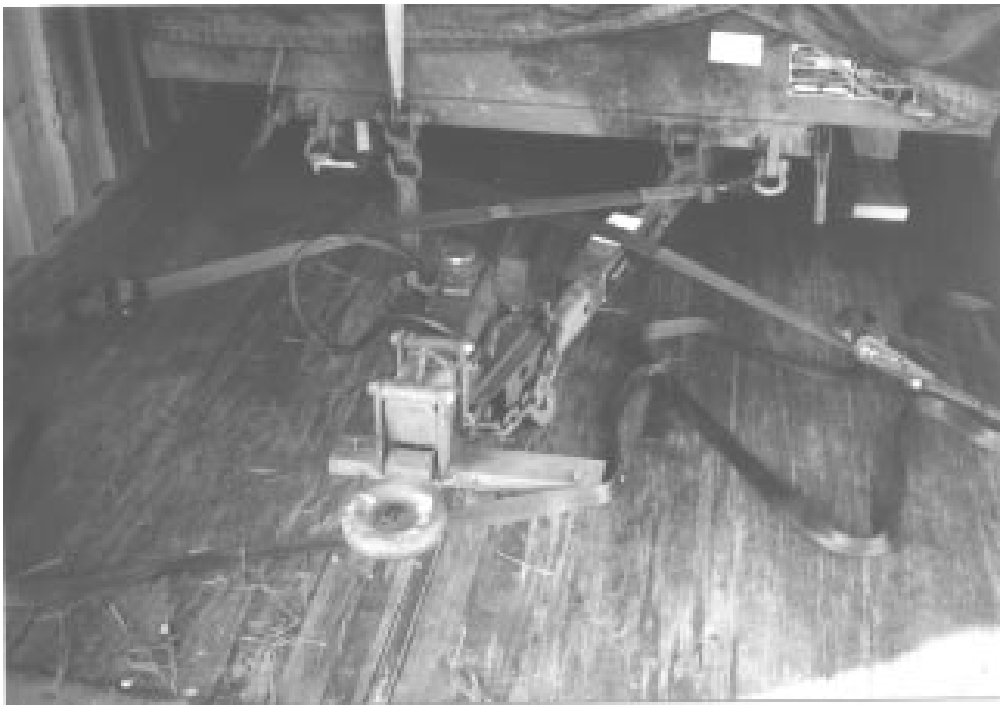


Figure 3-8. Single axle trailer tongue lashings.

G. Use of Number 9 Gauge Wire

Make a complete loop with the wire through a provision on the front of the trailer. Ensure that the loop is long enough to reach the container floor at a 45 degree angle. Construct the cleat as shown in figure 3-9 by nailing the two short boards to the long board. Place the cleat in the wire loop. Nail one end of the cleat to the floor with one nail so that the cleat can be rotated. Start a nail in the opposite end of the cleat. Push the free end of the cleat away from the vehicle to tighten up the wire loop. Once the wire is pulled tight, the nail should be driven in and five more nails added per end. Repeat this process for the other side of the trailer. If straps are used, they can be secured first, then tightened using the ratchet assembly. Straps can be fastened directly into the container D-rings, if available (fig 3-8).

H. Trailer Attached to Prime Mover

The trailer should be loaded as above, but instead of lowering the tongue, a prime mover would be loaded and the trailer attached to the prime mover. Nail the chock blocks in place after the trailer has been attached to the pintle. The pintle must be secured for shipment. Do not try to load the vehicles as a combination. The trailer and prime mover must be secured (as shown in fig 3-6) with the same blocking and lashing patterns as if they were being secured separately. Remember to use ground guides.

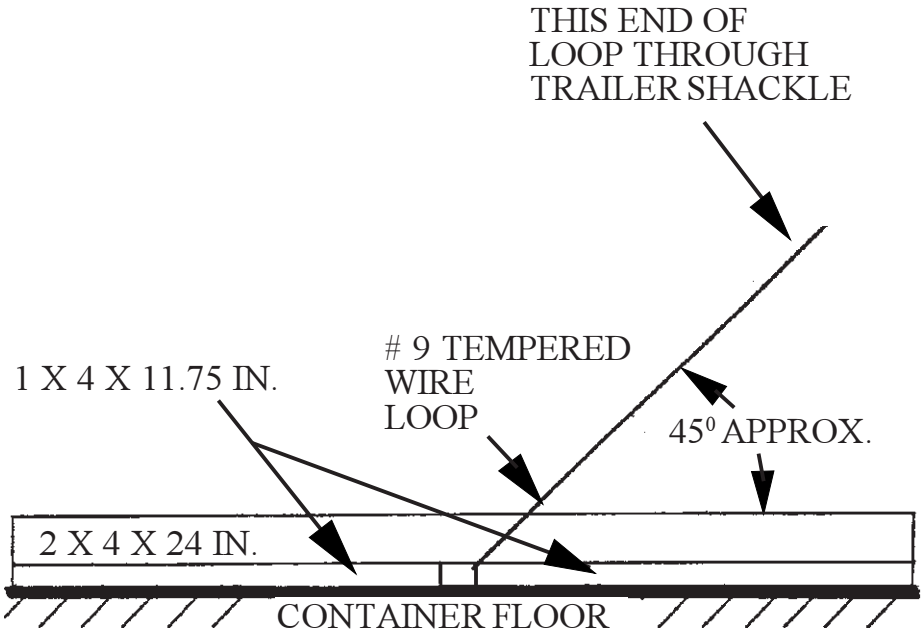


Figure 3-9. Application of number 9 gauge wire or strap as tiedown.

I. M119 Howitzers

The howitzers require a forklift with pintle attachment that is capable of traveling into the container. The howitzers are too tongue heavy to man handle into position. The drawings depict a different type of chock block and side bracing (figs 3-10 through 3-12) than was used previously. This tiedown arrangement is approved for rail shipment by container-on-flatcar (COFC), trailer-on-flatcar (TOFC) or double stack rail service. If highway and marine are the only modes used, the other simpler chock blocks (fig 3-3) with side bracing may be used. Figure 3-13 depicts the use of banding. The tongue will be secured as shown in figure 3-14 with two side braces and a piece of dunnage 2" x 4" x 24". Figure 3-15 is a side view of a single howitzer secured in a standard container. Detailed container outloading procedures may be obtained from the US Army Defense Ammunition Center and School, ATTN: SIOAC-DET, Savanna, Illinois, 61074-9639; procedural drawing number 1948-8105-15WE1.

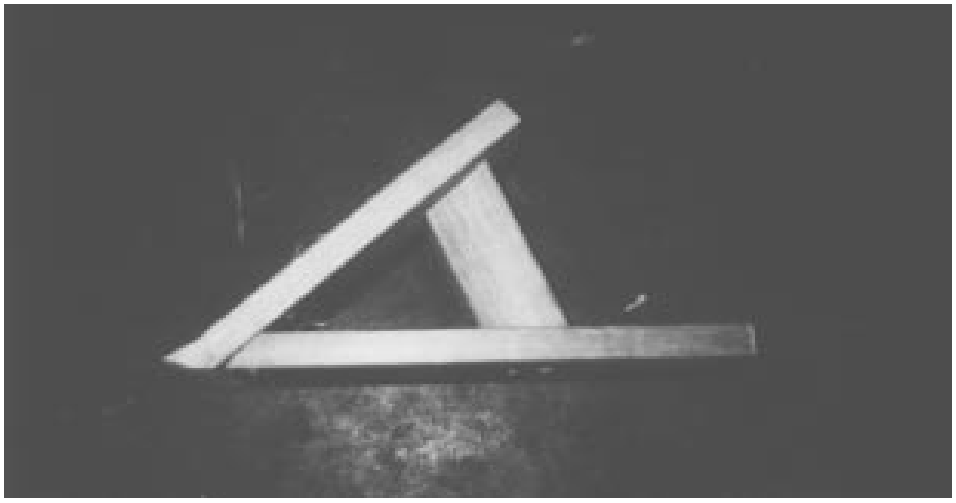


Figure 3-10. Howitzer chock block for rail transport.

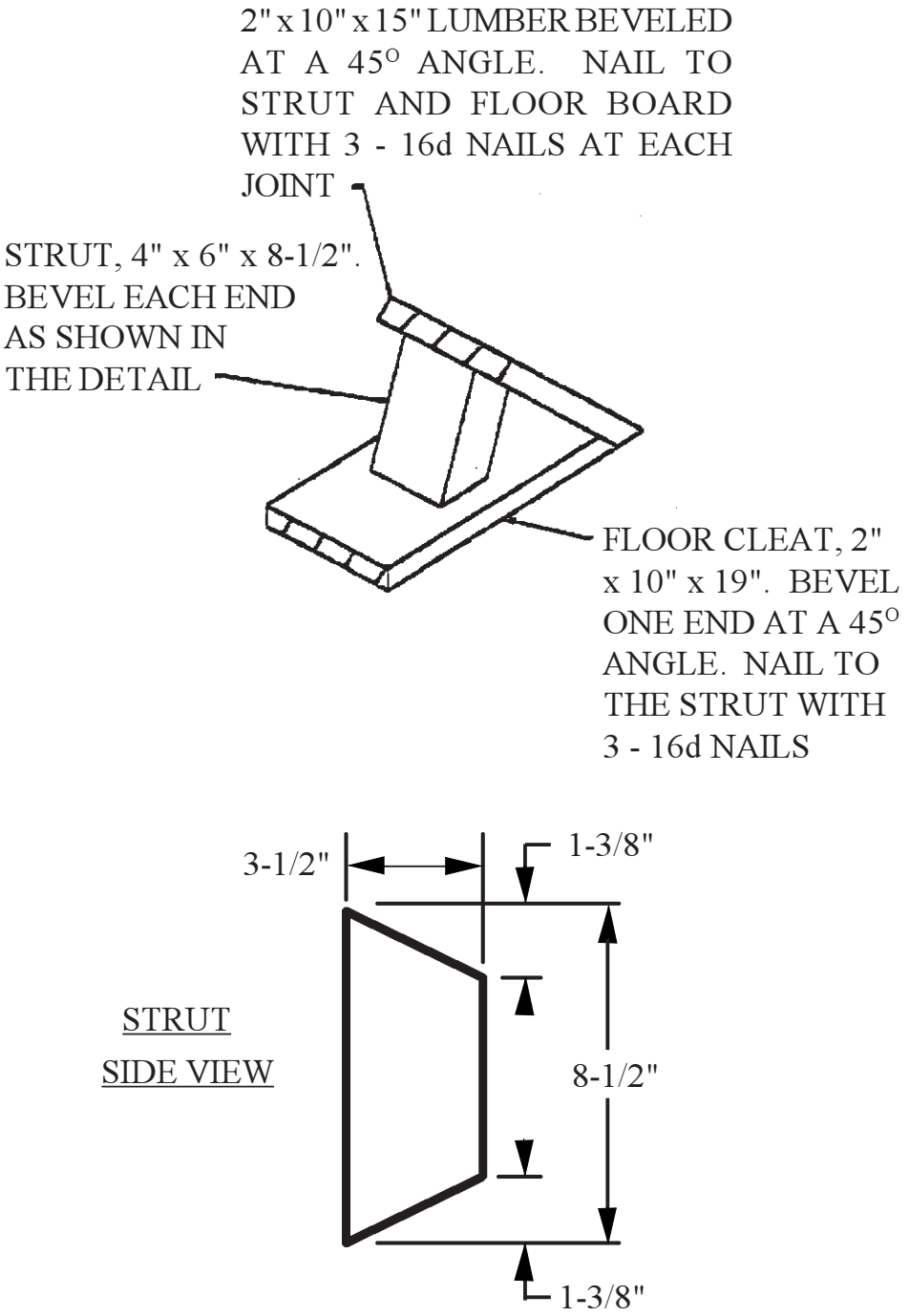
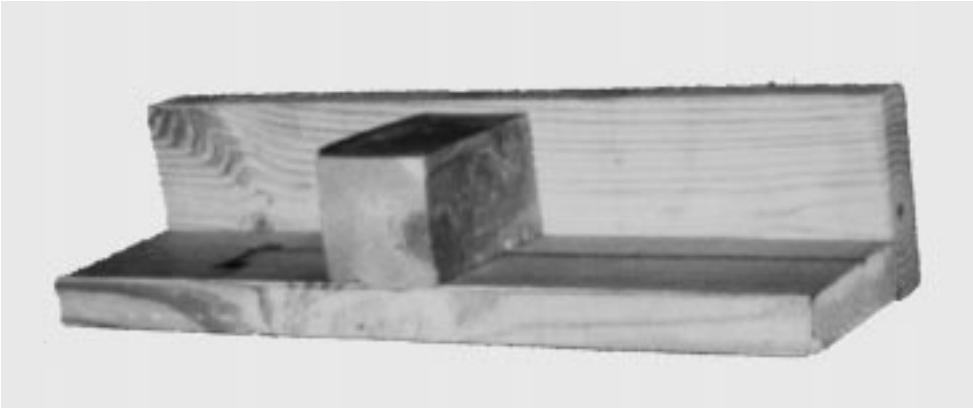


Figure 3-11. Howitzer chock block construction.



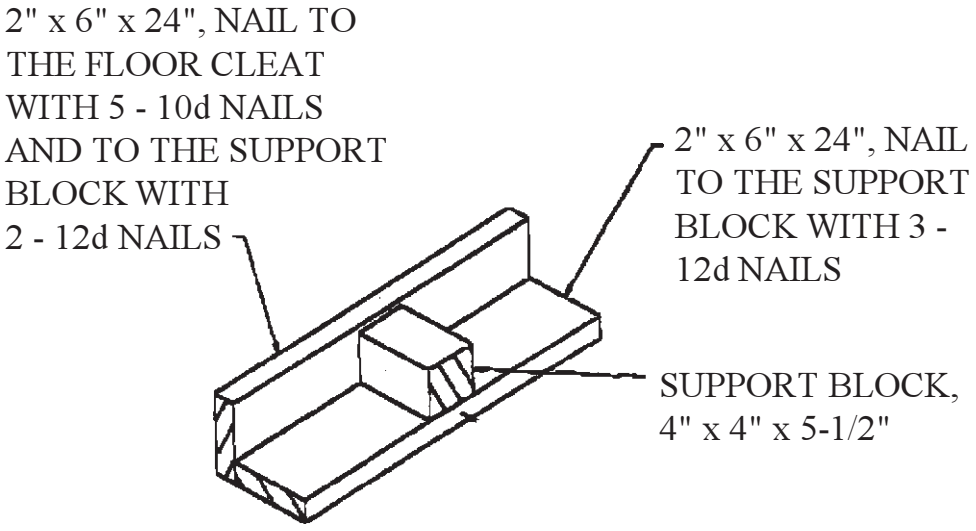


Figure 3-12. Side bracing for howitzer wheels and lunette.

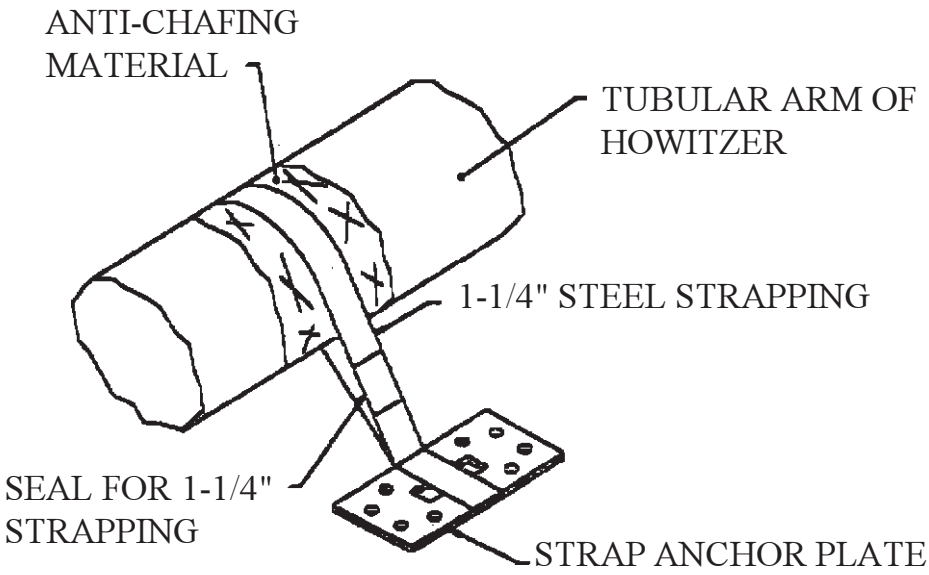


Figure 3-13. Use of banding.

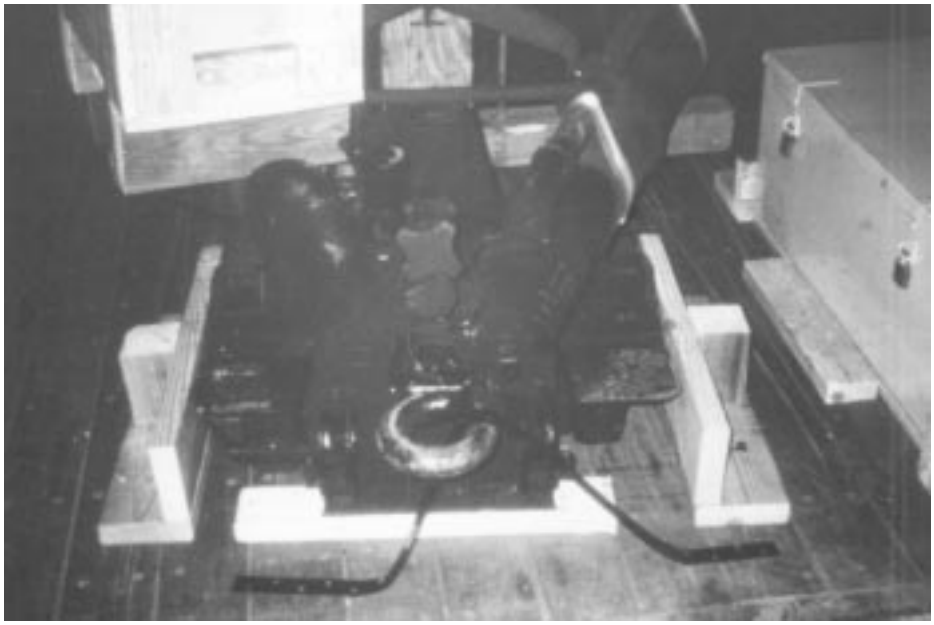


Figure 3-14. Detail of tongue securement.

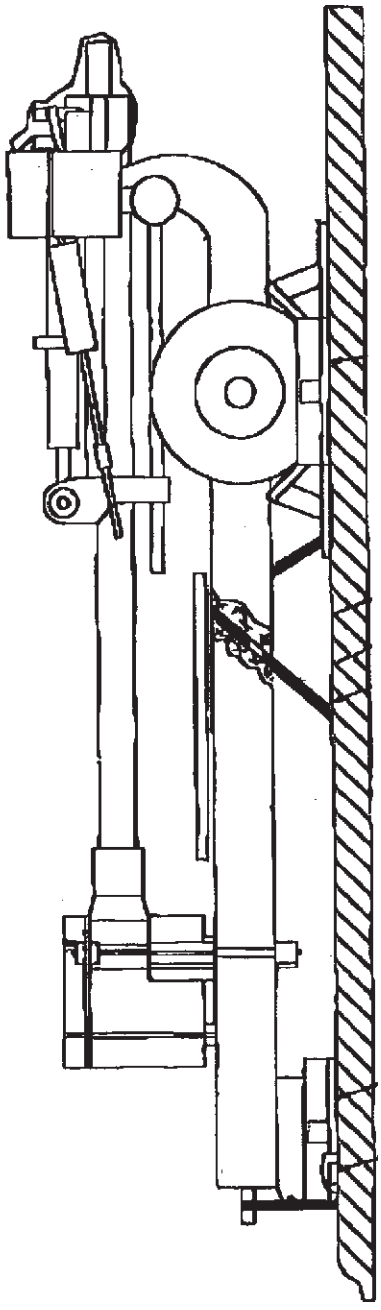


Figure 3-15. Side view of howitzer secured in container.

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SECTION IV. UNSTUFFING OR STRIPPING

WARNING

As chock blocks are removed, make sure nails are not left in the floor of the container. They are a hazard to people as well as equipment.

NOTE

Tanker pry bars are the most efficient tool for removing chock blocks. Try not to damage the chock blocks as they may be needed for redeployment. Also, store them in a secure place to prevent pilferage.

A. HMMWVs and CUCVs

The front chock blocks must be removed and a driver must climb into the vehicle. The vehicle is manually pulled and pushed out of the container. The batteries are reconnected and the vehicle is driven to a staging area or is coupled to a trailer and then driven to the staging area. If a vehicle will not start, make sure it is pushed clear before the next vehicle is unloaded. Remember to use ground guides.

B. Trailers

The tongue tiedowns are removed and the jack or landing leg is set in place. This allows more room for chock block removal. Once the chock blocks are removed the trailer can be manually pulled out of the container. Caution must be used when the tires roll down the ramp or just out of the door. The trailers can be manually positioned clear of the container door for unloading the next trailer or they can be coupled to a prime mover and towed to a staging area. For trailers coupled to prime movers, you must remove all of the prime mover's chock blocks and the front chock blocks and tiedowns of the trailer before unloading. If a forklift with pintle attachment is available, it may be used to remove the trailers from the container.

Use care when unloading trailers, especially when they are closely spaced. The first trailer to be unloaded can snag the cap on the hydraulic cylinder reservoir on the tongue of the trailer behind it. This will damage the cap.

C. Howitzers

Remove all blocking and bracing and pull howitzer out using a forklift with pintle attachment.

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SECTION V. FLATRACKS

This section provides users with the proper methods for securing vehicles on platform containers (flatracks) for shipment. It shows proper tiedown methods when military equipment will be shipped by platform containers via two or more modes (rail, highway, or marine). For true intermodal shipment of the cargo, it must fit entirely within the flatrack's internal dimensions; thus, it can be loaded onto the flatrack at origin and remain attached to it until it reaches its destination.

Flatracks can also be used purely for marine transport by providing "false decks" in support of lift-on/lift-off operations using containerships. When used in this way, the flatracks can support marine transport of wider and heavier loads by stretching the item across two or more flatracks. Flatracks are portable open-top, 'tween deck containers. They provide the capability to stow aircraft, vehicles, and outsize and breakbulk cargo, which can not be placed into containers.This publication does not contain tiedown procedures for flatracks configured as false decks. These tiedown procedures are found in: **MTMCTEA Ref 95-55-22,** ***Marine Lifting and Lashing Handbook.***

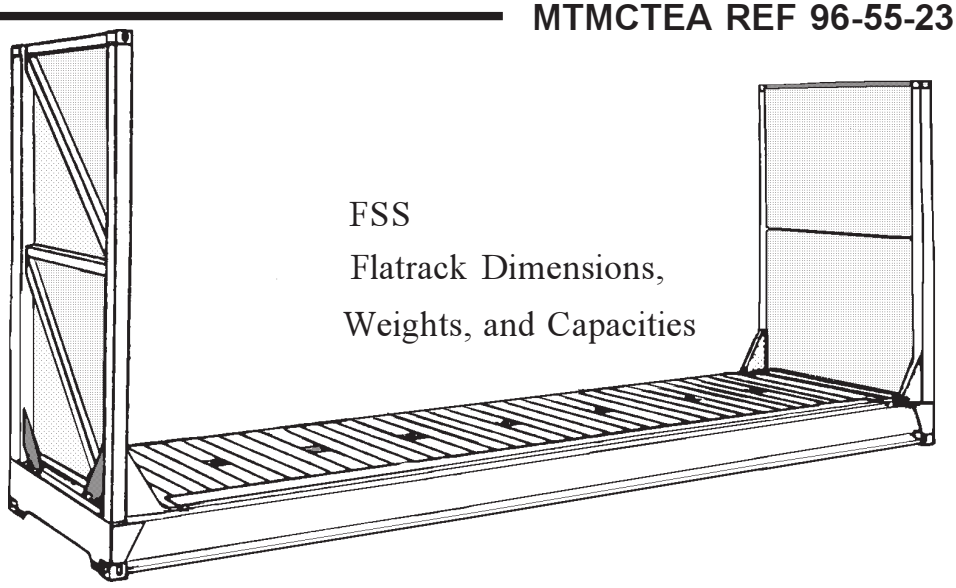
All equipment loaded onto flatracks for intermodal movement must be firmly and properly secured to counteract longitudinal, lateral, and vertical forces that might be encountered in the rail, highway, or marine modes, or during terminal handling. The longitudinal (forward and back) forces that may be encountered during rail transport are the most severe forces during any transport. Therefore, this section contains basic information from the Association of American Railroads (AAR) and from experience gained through the monitoring of military rail loadouts during exercises. The basic rail tiedown methods have been modified to ensure sufficient lateral (side to side) restraint is adequate for marine transport.

A. Thirty-Five-Foot Fast Sealift Ship (FSS) flatrack

Three types of flatracks have been installed on the FSSs. The dimensions, weights, and capabilities are listed in figure 5-1. These flatracks may be used as individual units or combined horizontally in sets of two or more. When placed side by side, an integral folding flap is positioned between the flatracks creating a flush deck. This flap provides the capability to stow cargo on more than one flatrack at a time (fig 5-2). Many railcars do not have container shoes positioned for transporting 35-foot containers. Few commercial containerships or chassis are configured to accept 35-foot containers. Special arrangements will be necessary if they are to be transported commercially.

B. Forty-Foot Heavy Duty Flatrack

The 40-foot heavy duty flatrack was developed to provide a breakbulk capability to containerships for the carraige of tanks and other heavy and/or outsized cargo. The 40' heavy duty flatrack is a relatively uncomplicated structual steel frame, decked over and fitted with tiedown points. There are two types of flatracks (fig 5-3), each having a different cargo capacity. The first type (Titan) has a cargo capacity of 67.2 short/tons and has telescoping corner posts, which are adjustible from 8.5' to 13.5' for various cargo heights. The second type of flatrack has fixed corner posts, 13' high with a clear internal height for cargo of 10.5' when transported by ship only. The corner post, on both types fold down to facilitate stacking and storage. Both flatracks may be inserted/removed into/from the containership cells empty or loaded maximum gross weight of 67,200 pounds. Heavier loads may be placed on three flatracks when they are used as false decks. Table 5-1 shows the overall dimensions and weights for both type of flatracks.



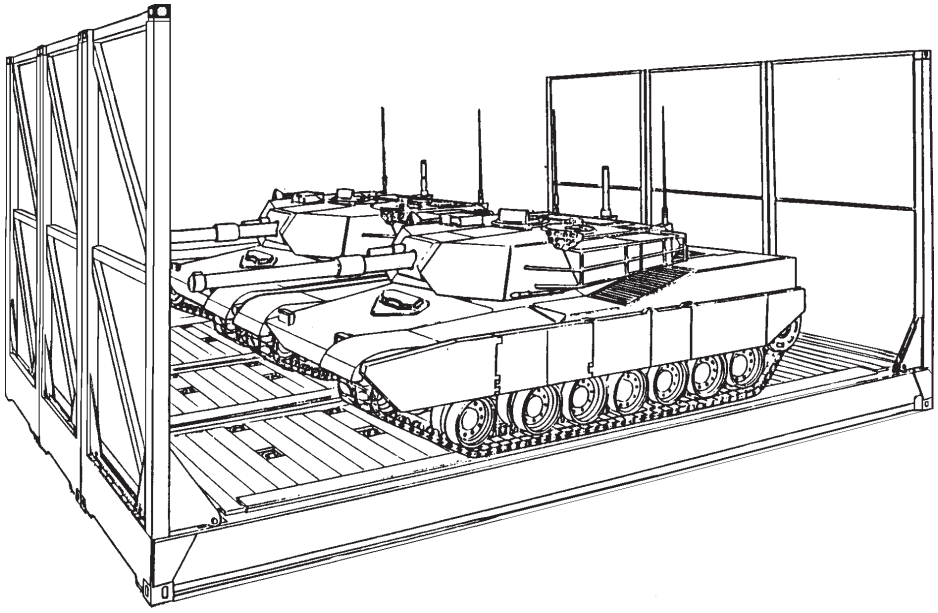
FSS
Flatrack Dimensions,
Weights, and Capacities

	Type I	Type II	Type III
Dimenisions (external) Length	35"-0"	35"-0"	35-0"
Width	8'-0"	8-0"	8-0"
Height	15'-3"	12'-0"	10'-3"
Dimenisions (Internal) Maximum/Carg Size Length	33'-9"	33'-9"	33'-9"
Width	8'-0"	8'-0"	8'-0"
Height	13'-6"	10'-3"	8'-6"
Weight of Flatrack	19,300 lb	17,841 lb	17,511 lb
Area of flatrack	270 sq ft	270 sq ft	270 sq ft
Volume of Flatrack	3,645 cu ft	2,768 cu ft	2,295 cu ft
Weight Capacities Lifting (note 1) Max (note 2)	35,700 lb 134,000 lb	37,159 lb 134,000 lb	37,489 lb 134,000 lb

Note 1: The maximum weight that can be placed on a flatrack that is to be lifted with a 35' container lifting spreader.

Note 2: The most weight that can be placed on a flatrack that has been positioned in a cargo hold.

Figure 5-1. Thirty-five-foot open-top, open-sided flatrack



As an example, three adjacent flatracks can accommodate two M1tanks during transport.

Figure 5-2. Flatracks used as a temporary 'tween deck'

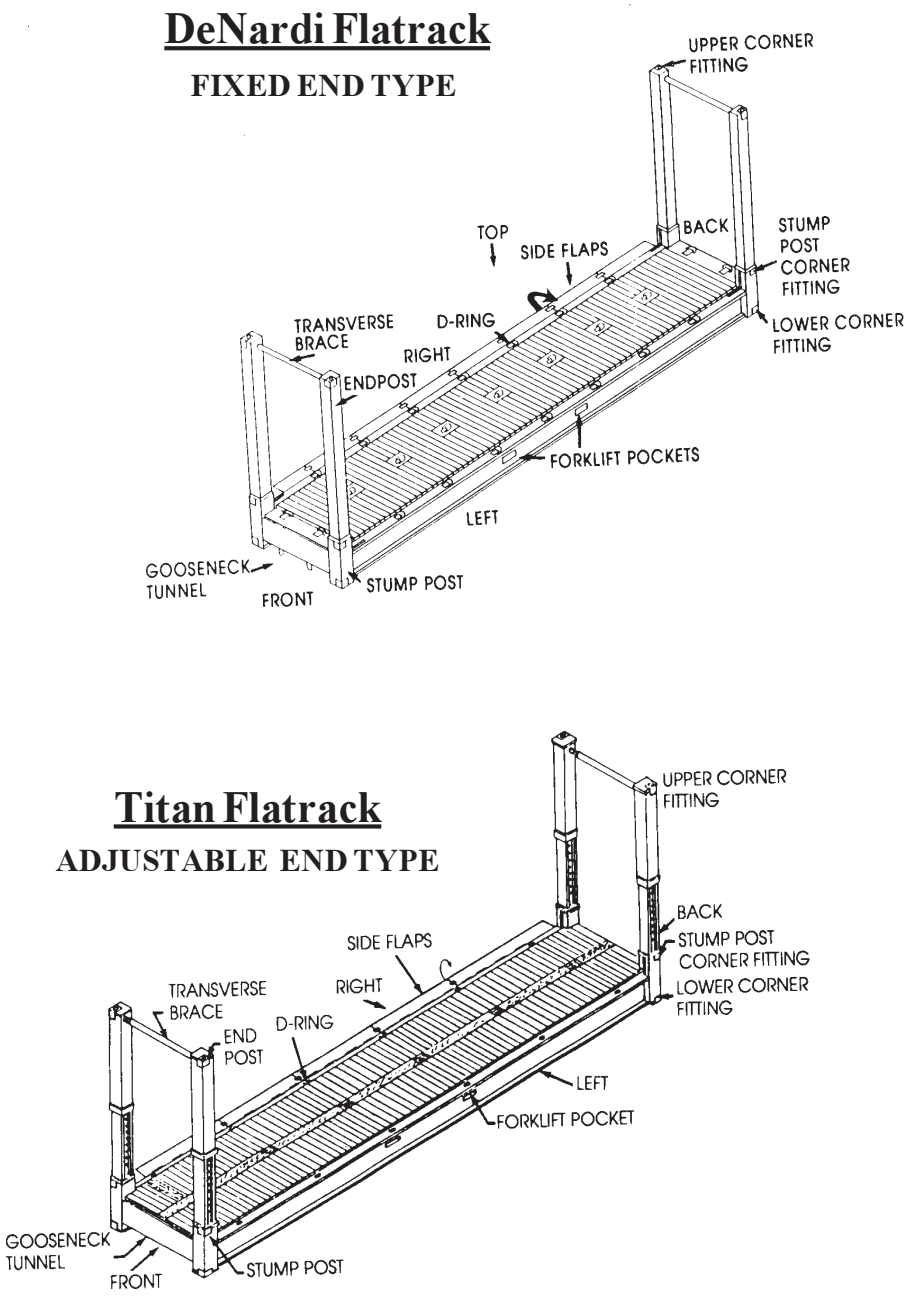


Figure 5-3. Forty-foot heavy duty flatracks

TABLE 5-1

Dimensions and weights for the DeNardi and Titan Flatracks

	DeNardi Flatrack	Titan Flatrack
Dimensions: External		
Length	**40’ - 0"**	**40’ - 0"**
Width	**8’ - 0"**	**8’ - 0"**
Height	**13’ -0"**	**11’ to 16’**
Dimensions: Internal		
Length	**38’ - 6"**	**38’ - 6"**
Width	**8’ - 0"**	**8’ - 0"**
Height	**10’ - 6"**	**13’ - 6"**
Weight of Flatrack	**18, 000 lbs**	**22,000 lbs**
Maximum Cargo Weight		
Flatrack lifted with cargo	**49,200 lbs**	**45,200 lbs**
Flatrack only used as a false deck on ship (No lifting)	**144,000 lbs**	**134,400 lbs**

C. Intermodal Flatracks

The following "general procedures" apply to vehicles on intermodal flatracks:

1. Gearshift Levers

Place gearshift levers of automatic or conventional transmissions in neutral and secure with wire. Set all parking brakes and then wire tie or block the hand levers. Setting the brakes is a precaution against the vehicle rolling inadvertently and not part of the securement.

2. Vehicle Spacing

It may be possible to fit two or more relatively small vehicles on the same flatrack. However, enough space must be kept between vehicles to allow tiedowns to be secured properly. In general, a two-foot spacing between vehicles on flatracks will be adequate. However, trailers may sometimes be placed much closer together. The AAR rules for flatcars state: "Items such as trailers and fork trucks may be loaded with the tongue or forks beneath the next vehicle, providing points where the vehicles may touch are separated by a minimum horizontal distance of ten inches and the tongue or forks are secured against vertical displacement." These conditions are also appropriate for intermodal transport on flatracks.

3. Securing Movable Structure

Equipment with rotating parts, such as tank turrets, and movable parts, such as crane outriggers and booms, must have those parts positively secured, usually with wire rope. This prevents the parts from moving out or up during shipment. Serious accidents can result from parts striking bridges or passing trains.

4. Vehicle Weight

The maximum gross weight of a 40-foot platform container **cannot** exceed 67,200 pounds for intermodal transport.

Since the flatrack itself will weigh about 17,000 pounds, a vehicle that weighs over about **50,000 pounds** cannot be shipped using intermodal flatracks.

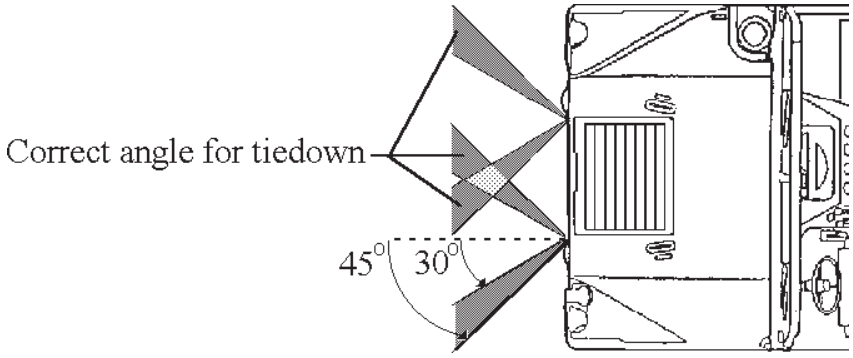
Verify the vehicle and container weights before each intermodal shipment. Ensure the vehicle (including its cargo) has been accurately weighed.

5. Forty-Five Degree Vertical Tiedown Angle

Place the vehicles on the flatrack so the tiedown chain makes an angle of approximately 45° with the floor of the flatrack when viewed from the side. Measuring by eye is usually good enough. If you want to layout the correct angle with a tape measure, make the longitudinal distance from the point the tiedown attaches to the deck to the tiedown provision on the vehicle equal to the vertical distance from the deck to the provision.

6. Lateral Tiedown Angle

Add tiedown chains so that they make an angle of 30° to 45° with the vehicle centerline when viewed from the top (next page). However, measuring by eye is usually good enough, but the tiedown pattern must be symmetrical in shape. Tiedowns do not have to be crossed; however, crossed tiedowns are acceptable provided they make the 30° to 45° angles.



Note: For ***conventional*** rail shipment same-side tiedowns are preferred, while for marine transport, crossed tiedowns are preferred. For intermodal shipment, a tiedown that primarily restrains longitudinally, but has a significant lateral component is best. This way adequate longitudinal restraint during the rail portion and adequate lateral restraint during the marine portion of the journey are both achieved.

7. Wheeled Vehicles

All wheeled vehicles must have their tires fully inflated to highway pressure. The tires must be capable of holding that pressure for at least the length of the trip. Tires are a part of the securement of the vehicle in that, if a tire goes flat, it will leave the tiedowns loose. Flat tires have started fires on moving trains by rubbing on the flatcar deck. This could also occur during intermodal shipment on flatracks. Also remember to fold in or remove overwidth mirrors.

8. Chock Blocks

Vehicles that are properly secured to intermodal flatracks with chains do **not** need any chock blocks.

9. Batteries

Disconnect vehicle batteries and tape terminals

10. Optional Loading Procedure

If cranes are not continuously available, flatracks can be positioned next to each other to allow the vehicles to drive into position. A ramp can be improvised using platform flatracks or commercial flatracks with ends folded flush as shown in figure 5-4. Figure 5-5 shows the overall arrangement of flatracks if vehicles will be driven on. Staggering the flatracks makes it easier to manuever the vehicles.

Figure 5-4. Improvised flatrack ramp

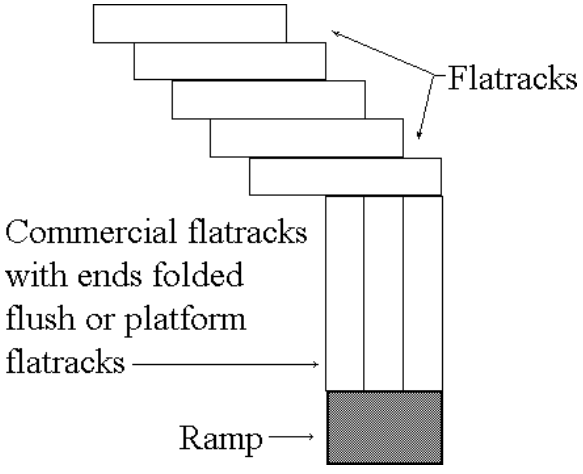


Figure 5-5. Top view of flatracks

11. Tiedown Procedure

Apply chain hooks over the vehicles' tiedown shackles, rather than under. Wire (or secure by other suitable means such as nylon tie straps) the grabhook to the chain link, as figure 5-6 shows, to prevent disengagment. If turnbuckles (used to tighten chains) are not equipped with jamnuts or a locking device, they must be wired to prevent them from loosening (fig 5-7). When using nylon straps, always look for sharp edges or rough surfaces that a strap will be pulled over. If this is necessary, put a piece of tire innertube between the strap and the sharp surface. This will prevent cutting, shaving, and sliding.

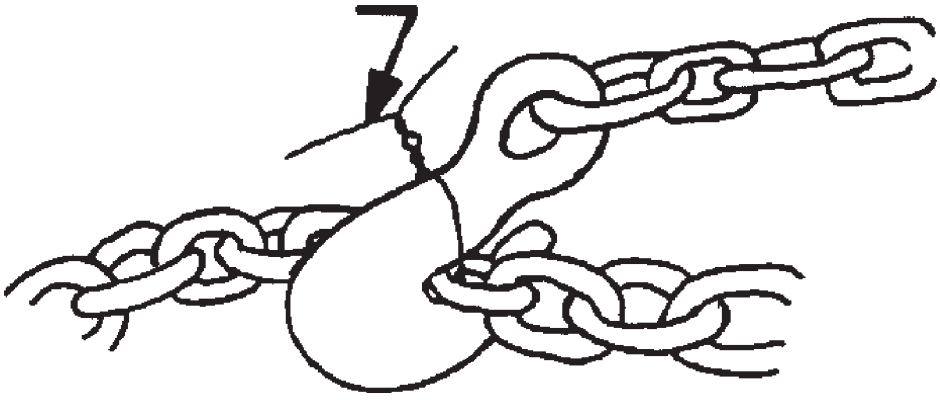


Figure 5-6. Proper securement of grabhook and chain link

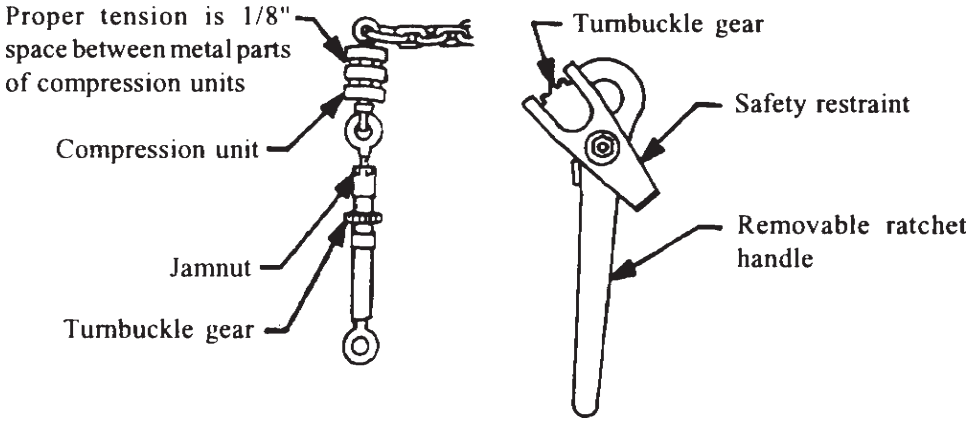


Figure 5-7. Turnbuckle

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SECTION VI. LASHING VEHICLES ON FLATRACKS

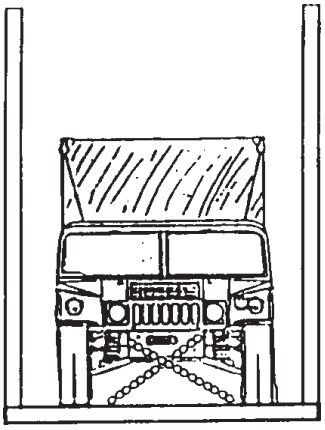
Apply tiedown chains symmmetrically around the vehicle with an angle from deck to chain of about 45 degrees. The angles the chains make with the vehicle centerline when viewed from the top should be about 30 to 45 degrees. Measuring by eye is usually good enough. When attaching chains to the vehicle, secure the shortest chains first and the longest chains last. A properly tensioned tiedown will deflect no more than about an inch with the weight of a person standing on it. Tiedown patterns are shown in figures 6-1 to 6-3.

The general guidelines for securing wheeled vehicles on chain-equipped cars by diameter of chains is as follows:

Number of Chains	Size (in)	Proof-Tested (lb)	Working -load Limit (lb)	Vehicle Weight (lb)
4	3/8	13,200	6,600	12,000 or less
4	3/8	18,000*	9,000	16,000 or less
8	3/8	32,000*	9,000	32,000 or less
4	1/2	22,500	11,250	20,000 or less
4	1/2	27,500*	13,750	25,000 or less
8	1/2	27,500*	13,750	55,000** or less

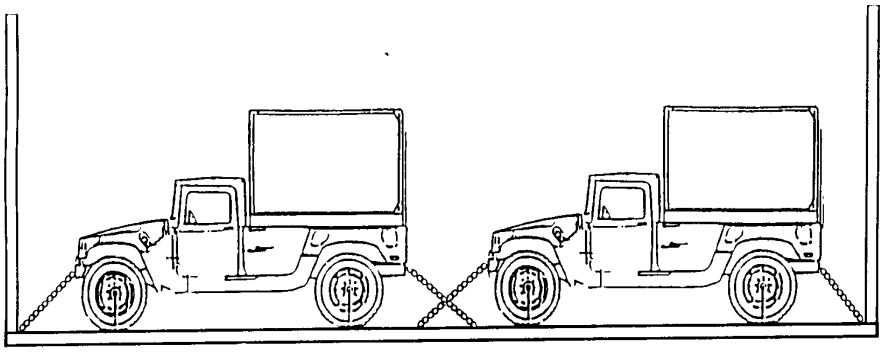
* - Extra strength

** - Maximum gross weight of platform container and vehicle must be less than 67,200 pounds



NOTE:

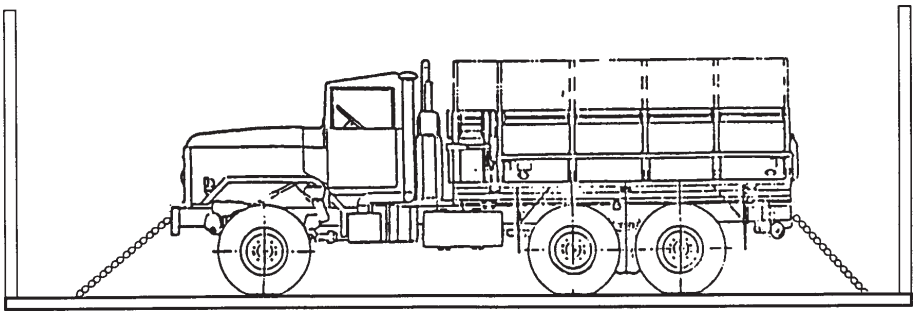
On flatracks without D-rings on the ends, the chains will have to be crossed under the vehicle



Maximum Vehicle Weight (lb)	Alloy Steel Chain			
	Chain Size (in)	Minimum Working Load Limit (WLL) (lb)	Breaking Strength (Approx lb)	Number of Chains Required Per Vehicle
12,000	3/8	6,600	26,000	4
16,000	3/8	9,000	36,000	4
20,000	1/2	11,250	45,000	4
25,000	1/2	13,750	55,000	4

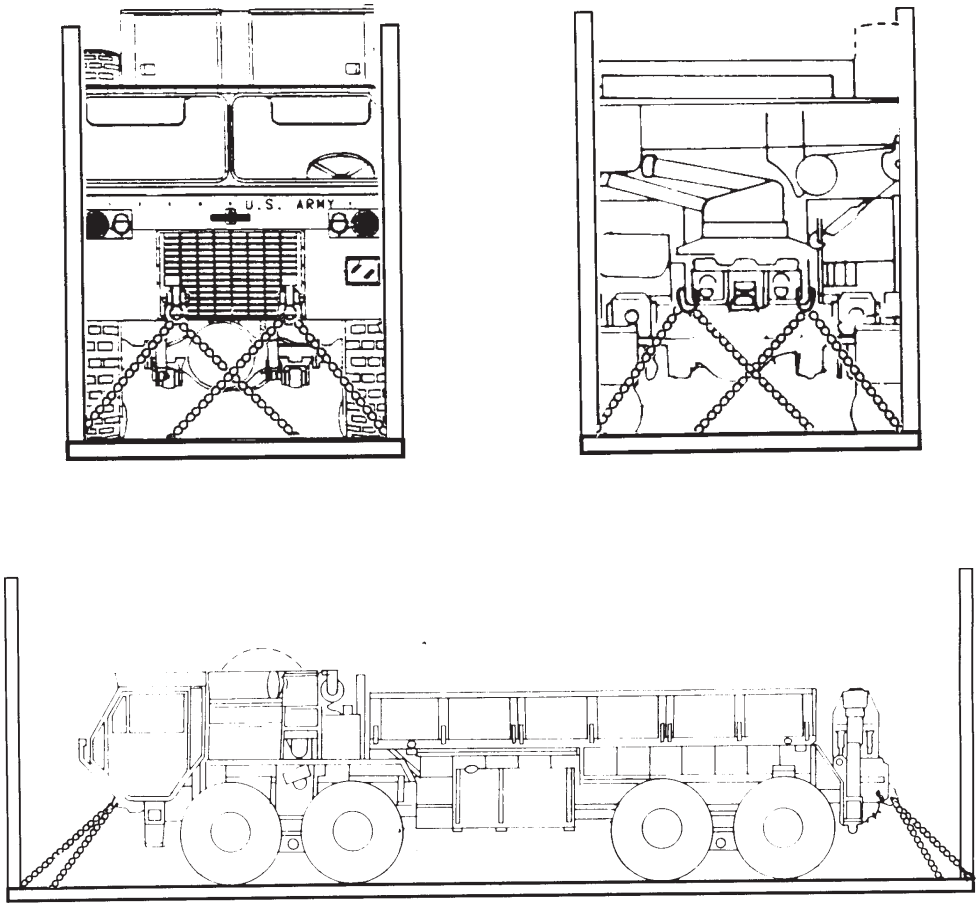
Figure 6-1. Two-axle vehicles.

Steel chains (see below for number required)



Maxium Vehicle Weight (lb)	Alloy Steel Chain			
	Chain Size (in)	Minimun Working Load Limit (WLL) (lb)	Breaking Strength (lb)	Number of Chains Required per Vehicle
16,000	3/8	9,000	36,000	4
24,000	3/8	6,600	26,000	8
32,000	3/8	9,000	36,000	8
20,000	1/2	11,250	45,000	4
25,000	1/2	13,750	55,000	4
40,000	1/2	11,250	45,000	8
55,000	1/2	13,750	55,000	8

Figure 6-2. Three-axle vehicles



Maximum Vehicle Weight (lb)	Alloy Steel Chain			
	Chain Size (in)	Minimum Working Load Limit (WLL) (lb)	Breaking Strength (lb)	Number of Chains Required per Vehicle
20,000	1/2	11,250	45,000	4
25,000	1/2	13,750	55,000	4
40,000	1/2	11,250	45,000	8
55,000	1/2	13,750	55,000	8

Figure 6-3. Four-axle vehicles

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